PUBLIC POLICY PROPOSAL TO REDUCE AIR POLLUTION IN CHINA

by
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Abstract

Chinese Air quality trails the Air Quality standards by WHO exposing over 81% of the Chinese population to related threats. In 2014, China was ranked the second-worst on air quality, globally, with a score of 18.81, and only 9 out of 100 cities in the country had attained the WHO standards. This has exposed the Chinese people to adverse health issues and increased economic costs. Premature deaths from exposure to O3 in China increased from 2013 to 2018 with 36% (short-term) and 59% (long-term). The costs of non-communicable diseases between 2015 and 2030 in China are projected to be $449 billion, where the largest costs are from air quality related diseases. The procedure to analyze the problem involved a study of the history of previously implemented policies such as the 14th five-year plan (2021-2025), various historical legislations and amendments, and key actors. Nevertheless, policy and political analyses informed the procedures to complete the policy proposal. The analysis has revealed that China could achieve its goals for improved air quality by increasing the production and use of renewable energy sources. The realization of the policy goal will require different actors and stakeholders to play part. Finally, the policy should not be implemented in isolation, but should supplement other already existing policies that the Chinese government has introduced to confront the threat of air pollution.

Keywords： Air pollution，Public health，Renewable energy

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DECISION MEMORANDUM

FROM: Xiangyi Xu

TO: President Xi Jinping

DATE: December 1, 2021.

SUBJECT: Public Policy Proposal to Reduce Air Pollution in China

Action Forcing Event

In March 2021, the Chinese government under the leadership of President Xi Jinping published the 14th five-year plan (2021-2025) policy. The policy presented a plan that the government has towards reducing emissions to improve environmental health while supporting innovative-driven growth of the economy. The policy will enable China to increase the production of non-fossil fuel energy to reach 20% of the country's energy mix by 2030 and halt the development of coal-powered plants.[1]

Statement of the Problem

Air pollution is a threat to public health and economic growth in China today, which emphasizes the need for public policy development and reforms to confront related problems. Fine particulate matter and greenhouse gases are contributing to air pollution in China.[2] $PM_{2.5}$ concentrations in China exceed the Air Quality Guideline set by the World Health Organization (WHO), exposing over 81% of the country's population to potential health risks from air pollution.[3] Besides, in 2014, China was ranked the second-worst on air quality, globally, with a score of 18.81, a significant drop of 14%, from a similar ranking in

[1] Nicholas Stern and Chunping Xie. "China's new growth story: Linking the 14th Five-Year Plan with." (2021).
[2] Kunlun Wang, Hongchun Yin, and Yiwen Chen. "The effect of environmental regulation on air quality: A study of new ambient air quality standards in China." *Journal of Cleaner Production* 215 (2019): 268-279.
[3] Peng Yin et al. "The effect of air pollution on deaths, disease burden, and life expectancy across China and its provinces, 1990–2017: an analysis for the Global Burden of Disease Study 2017."

2004. WHO report on environmental quality in China in 2014 indicated that only nine cities from 100 met the global air quality standards.[4] The greatest sources of air pollution in China are coal production, coal consumption, increased car ownership, and electricity production.[5]

Air pollution from ambient air pollutants $PM_{2.5}$ (fine particulate matter) and Ozone (O_3) in China is noted to worsen public health, leading to premature deaths. The health implications result in direct, indirect, and intangible health care costs. Between 2013 and 2018, the premature deaths linked to exposure to O_3 in the short- and long-term increased by 36% and 59% respectively. The related healthcare costs doubled in 2018, as compared to O_3 costs in 2013. The premature deaths from $PM_{2.5}$ dropped by 15% and 59% in the same period but associated healthcare costs had insignificant change.[6] As part of the research recommendations, the Chinese government should prioritize actions to reduce $PM_{2.5}$ and O_3 emissions to promote the social well-being and public health of its people.[7] Air pollution from the manufacturing and transportation sectors in China is contributing to millions of deaths in the country every year, making the concern a public health issue.[8] The consequences of air pollution in China are worsening disease burden, leading to reduced productivity, and increasing healthcare costs, which are noted to offset the financial gains that have been realized as a result of tremendous industrialization in China.[9]

Air pollution in China is leading to non-communicable diseases, increasing the economic burden. From 1990 to 2030, it is estimated that the total economic losses from

[4]Xiaoyao Xie, and Yuhong Wang. "Evaluating the efficacy of government spending on air pollution control: a case study from Beijing." *International Journal of Environmental Research and Public Health* 16, no. 1 (2019): 45.
[5] Yigang Wei et al. "Uncovering the culprits of air pollution: evidence from China's economic sectors and regional heterogeneities." *Journal of Cleaner Production* 171 (2018): 1481-1493.
[6] Jun Liu et al. "Transition in air pollution, disease burden and health cost in China: A comparative study of long-term and short-term exposure." *Environmental Pollution* 277 (2021): 116770.
[7] Jun Liu et al. "Transition in air pollution, disease burden and health cost in China."
[8] Chaopeng Hong et al."Impacts of climate change on future air quality and human health in China." *Proceedings of the National Academy of Sciences* 116, no. 35 (2019): 17193-17200.
[9] Jun Liu et al. "Transition in air pollution, disease burden and health cost in China: A comparative study of long-term and short-term exposure." *Environmental Pollution* 277 (2021): 116770.

noncommunicable diseases linked to air pollution in China are $1,137 billion (given constant 2010 USD), whereas the costs from 2015-2030 are forecasted to be $449 billion.[10] The highest disease burden from air pollution is cardiovascular diseases (was 80% in1990), followed by chronic respiratory health complications, cancer, and diabetes. In 1990, air pollution resulted in 18.1% of noncommunicable deaths in China, but this has over the years decreased to reach 13.1% deaths in 2015.[11] Between 2002 and 2014, it was observed that the costs of healthcare as a result of air pollution in the country increased from 0.3988 Moran's I index to 0.4554.[12] The healthcare costs for the diseases caused by air pollution account for 30% of the economic burden among the Chinese people. Air pollution is linked with a higher rate of chronic respiratory mortalities in China as compared to other disease categories.[13] Air pollution is a major cause of death and disability worldwide and in China. It is estimated that in 2015, there were over 103.1 million cases of disability and 4.2 million deaths from air pollution, globally.[14] A similar observation has been made in China in recent times, where incidents of health complications and diseases from air pollution are high. China is the fastest-growing economy globally, as has been the trend in the last four decades. The significant economic growth has been contributing to increased water contamination, air pollution, and other severe environmental issues. This has seen the country introduce policies and legislations such as the Air Pollution Prevention and Control Action Plan and the Ambient Air Quality Standards, which have positively helped improve air quality.[15] Currently, air pollution is contributing to increased morbidity and mortality among

[10]Simiao Chen, and David E. Bloom. "The macroeconomic burden of noncommunicable diseases associated with air pollution in China." *PloS One* 14, no. 4 (2019): e0215663.
[11] Simiao Chen, and David E. Bloom. "The macroeconomic burden of noncommunicable diseases associated with air pollution in China."
[12]Juying Zeng and Qiuqin He. "Does industrial air pollution drive health care expenditures? Spatial evidence from China." *Journal of Cleaner Production* 218 (2019): 400-408.
[13] Simiao Chen, and David E. Bloom. "The macroeconomic burden of noncommunicable diseases associated with air pollution in China."
[14] Shilu Tong. "Air pollution and disease burden." *The Lancet Planetary Health* 3, no. 2 (2019): e49-e50.
[15] Shilu Tong. "Air pollution and disease burden."

many Chinese people. However, with the policies and legislation to reduce air pollution as identified above, it is anticipated that the related premature deaths will drop by 13.5% in 2020 and 22.8% in 2030, as compared to 2010. Consequently, the reduction of the potential health burden associated with air quality requires stringent measures to improve air quality and protect the health and lives of Chinese citizens.[16]

President Xi Jinping is committed to ensuring that China does not prioritize economic growth at the expense of public health. For instance, the president led China with the introduction of the 14th Five-Year Plan to enable China to reduce emissions that increase air pollution in China. Unfortunately, the plan is ineffective considering that it fails to provide explicit details on how the government will lead the country to achieve the climate change goals and the ideal metrics. The policy explains the economic development and climate change targets for China in the next decade but fails to explicitly explain how to get there, which could make the implementation of the policy and the ability to achieve the intended goals challenging. For instance, the policy sets a target to reduce carbon dioxide intensity by 18% and a reduction of energy intensity by 13.5% from 2021-2025.[17] However, the plan fails to illustrate how the targets are to be met. This is emphasized in a report by the United Nations Development Programme (UNDP), the implementation of the plan is dependent on two crucial tools, carbon, and energy intensity which impact air quality through the associated emissions. Unfortunately, the tools lack clarity with the indicators to reduce absolute emissions levels at a fast pace, based on the urgency of the environmental problems that the policy should help confront. The 14th five-year plan is light in details and practicality limiting China to put in place robust strategies and policies for fulfilling its 2030-2060 climate

[16] Shilu Tong. "Air pollution and disease burden."
[17] Hongqiao Liu et al. “Q&A: What does China's 14th 'five-year plan' mean for climate change?” *Carbon Brief*, March 12th, 2021.

change goals as committed during the Paris Agreement.[18] In other words, the policy fails to provide clarity to urgently confront the problem of emissions and worsening air quality, which requires immediate response actions. Similar inadequacies are noted with the carbon dioxide (CO2) cap requirement, which was introduced through the plan, where the policy fails to set a specific cap to limit carbon emissions in China.[19] Without clear signals, targets, and explicit emission caps to guide climate actions in the country, the associated risks and costs increase leading to irreversible effects.

Finally, another concern with the current government's approach to confronting air pollution relates to the president's lack of goodwill and support from local leaders, considering that the leaders only commit to reducing air pollution in their cities days before President Jinping visits the cities, but the measures are removed after the visits.[20]Thus, the solutions for improving the air quality across Chinese cities are ineffective because they are short-term, whereas the resulting public health risks are long-term. The air quality deteriorates after the presidential visits, getting back to previously worse levels.[21] The observation suggests the need for sustainable actions to ensure continued efforts for the development and implementation of long-term solutions to improve the air quality in China. If this is not achieved, the Chinese government, under the leadership of President Jinping, will fail in one of its primary mandates to protect and promote health among its citizens. Consequently, strict policy reforms are essential to reduce air pollution and to address the associated public health and financial burdens among the Chinese people.

[18] United Nations Development Programme. "China's 14th five-year plan Spotlighting climate and environment." *UNDP,* July, 2021.
[19] Hongqiao Liu et al. "Q&A: What does China's 14th 'five-year plan' mean for climate change?" *Carbon Brief*, March 12th, 2021.
[20] Qingling Shi, Chenchen Shi, and Feng Guo. "National leaders' visits and temporary improvement of air quality: evidence from Chinese cities." *Empirical Economics* 58, no. 5 (2020): 2105-2127.
[21] Qingling Shi, Chenchen Shi, and Feng Guo. "National leaders' visits and temporary improvement of air quality: evidence from Chinese cities."

History/Background

The problem of air pollution in China has lasted for decades and could persist for decades to come if immediate sustainable solutions to the problem are not pursued. Over the years, China has created and implemented policies to confront the problem of climate change and air pollution. The air pollution policies that have been implemented in China over the years are comprised of five primary series of policies that are intertwined in different levels of government. The categories are environmental laws and standards, national plans and five-year plan (FYP) frameworks, the ten specific conventional regulatory measures (were solidified from 1972 to 1989), special actions beyond the FYPs to introduce temporary relief measures in response to ineffective regular strategies, and the environmental-related state ideologies like the Green GDP", "Low-Carbon economy", and "Cleaner Production.[22] The assessment of the different policies will help appreciate the origins of air pollution and evaluate the strengths and weaknesses associated with the different policies to identify areas to be targeted to improve the effectiveness of the current policies that the country is pursuing in the leadership of President Jinping.

The air pollution challenge that China has faced in recent times emerged in late 1970s, following the implementation of the “Reform and Open Policy”. The policy introduced in era that saw China pursue an ambitions and rapid economic development. This resulted to excessive use of natural resources, and increased industrialization activities, increasing air and environmental pollution.[23] Reform and Open Policy contributed to unprecedented economic development in China, where within a period of three years, the urbanization levels increased from 17.9% in 1978 to 54.8% in 2014. As a result of the urbanization, China

[22] Yana Jin, Henrik Andersson, and Shiqiu Zhang. "Air pollution control policies in China: a retrospective and prospects." *International Journal of Environmental Research and Public Health* 13, no. 12 (2016): 1219.
[23]Rodolfo Andres Hernandez. "Prevention and control of air pollution in China: a research agenda for science and technology studies." SAPI EN. S. Surveys and Perspectives Integrating Environment and Society 8.1 (2015).

experienced myriad social inequalities and environmental problems, making it impossible to achieve urban sustainability.[24] The rapid expansion of the Chinese economy as has happened in the past four decades has contributed to serious air pollution problems witnessed in the country. The Chinese government has focused to address the potential threats resulting from air pollution, where every year, huge sums are invested to confront related problems.[25] Figure 1 below shows the trend of air pollutants in China from 1990 to 2017. There was a significant increase in the release of air pollutants from 1990 until 2012, when the air pollutants started reducing until 2017. The increase in air pollutants in China in 1990-2012 could be linked to increased economic activities, whereas the reducing levels of air pollutants since 2013 could be linked to the policies introduced to mitigate air pollution.

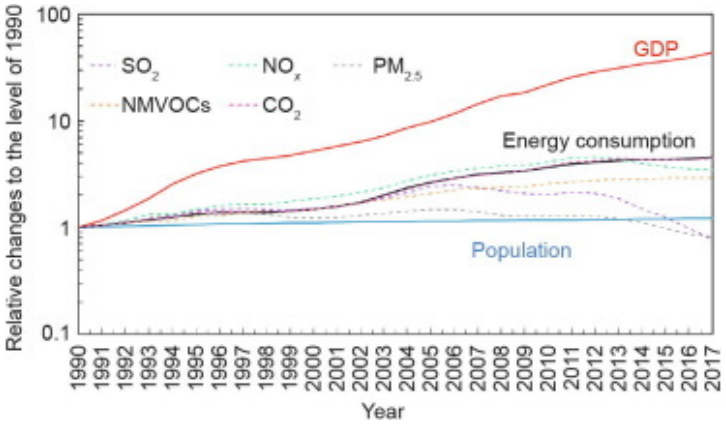

Figure 1: Historical trend of air pollutants in China [26]

The problem of increased air pollution in China is noted to have occurred in three phases, in 1970-1990, 1990-2000, and 2000-to-present. In the first phases, 1970-1990, the dominating causes for air pollution were coal burning stoves in households, industry and power plants. The air pollutants from coal smoke included (total suspended particulates) TSP, Sulfur

[24]Lu Huang, Lijiao Yan, and Jianguo Wu. "Assessing urban sustainability of Chinese megacities: 35 years after the economic reform and open-door policy." *Landscape and Urban Planning* 145 (2016): 57-70.
[25]Xiaoyao Xie, and Yuhong Wang. "Evaluating the efficacy of government spending on air pollution control: a case study from Beijing." *International Journal of Environmental Research and Public Health* 16, no. 1 (2019): 45.
[26] Xi Lu et al. "Progress of air pollution control in China and its challenges and opportunities in the ecological civilization era." *Engineering* 6, no. 12 (2020): 1423-1431.

dioxide (SO_2), carbon monoxide (CO), and nitrogen oxides (NO_x). A significant increase in vehicles in 1990-2000, and emergence of megacities led to increased air pollution in VOCs and NO_x. After 2000, increased vehicle ownership, burning of coal, industrial processes, and dust from construction sites are identified as the major causes of air pollution.[27] However, as the threat of air and environmental pollution has increased in China, policies and legislations have previously been introduced to mitigate the potential threats. As revealed in the problem description section, despite the introduction of policies to mitigate air pollution, the air quality in China is below the global standards, suggesting the need for policy improvement.

A major legislation that has previously been introduced to confront the threat of air pollution in China is the Air Pollution Prevention and Control Law, which was enacted in 1987 and links to the Prevention and Control: Air Pollution (PCAP) policy. The legislation was enacted by the Chinese National People's Congress, and introduced emission standards, where those who exceeded the limit would face legal charges and fines. The 1987 air pollution prevention law was further improved over the years, to become a crucial legislation guiding the Chinese government's efforts to mitigate the potential threats from air pollution.[28] For instance, the legislation was revised and improved in 1995, 2000, and 2015, to increase the urgency of confronting the threat of air pollution in China.[29] The recent update of the legislation which happened in 2015 led to the introduction of the New Air Law which has prioritized air quality management. Through the law, cities across China are required to regularly release and submit plans indicating that they are on course to meeting

[27]Yana Jin, Henrik Andersson, and Shiqiu Zhang. "Air pollution control policies in China: a retrospective and prospects." *International Journal of Environmental Research and Public Health* 13, no. 12 (2016): 1219.
[28] Rodolfo Andres Hernandez. "Prevention and control of air pollution in China: a research agenda for science and technology studies." SAPI EN. S. Surveys and Perspectives Integrating Environment and Society 8.1 (2015).
[29] Ying Li and Ke Chen. "A review of air pollution control policy development and effectiveness in china." *Energy Management for Sustainable Development* (2018): 1.

air quality goals, and if not, explain what they are doing to achieve the targets.[30] The new legislation was the first for China to control greenhouse gasses (GHGs) through addressing the sources of related emissions including from agricultural machinery, marine vessels, food industries, construction sector, vehicles and coal production and use. The revised legislation requires the involvement of the public to address air pollution problems in China. Regional governments are required to protect the confidentiality of the whistleblowers who might report incidents of illegal pollution, and if the accusations are proved to be correct, offer rewards. This is aimed at encouraging the public to help support the enforcement efforts as they are identified as key stakeholders in environmental protection.[31] The improvement of the previous policies and legislations confronting air pollution in China, as witnessed in recent times is focusing on joint control and administration. A combination of the Air Pollution Control Act and the Environmental Protection Act of 2015 has enabled China to lay a strong foundation for controlling air pollution. Unfortunately, the implementation of the laws is confronted by obstacles including lack of public involvement, unclear accountability mechanism, inefficient regional collaboration, and the absence of structured and regional pollution management. The challenges should be addressed by improving China's legal system targeting air pollution control.[32]

Additionally, the other policies to confront air pollution in China were implemented between 2005 and 2017. For instance, the coal-to-gas policy was introduced in China in 2005 focusing on reducing air pollution from the combustion of coal. The implementation of the policy has enabled China to reduce coal combustion by over 11 million tons until 2017. Also, the policy has enabled the introduction of high-efficiency terminal treatment facilities in China to

[30] Zhao Lijian, Tonny Xie, and Jenny Tang. "How China's new air law aims to curb pollution." *China Dialogue* 30 (2015).
[31]Zhao Lijian, Tonny Xie, and Jenny Tang. "How China's new air law aims to curb pollution." *China Dialogue* 30 (2015).
[32] Liu Yan. "Legislation of air pollution control in China". *IOP Conf. Series: Earth and Environmental Science* 512 (2020) 012029

reduce emissions. This has led to a significant reduction of SO_2, $PM_{2.5}$, and NO_x emissions with 98%, 97%, and 86% respectively in the period. As a result, China has realized significant health and environmental benefits in the period compared to the previous 20 years period.[33] Also, in 2005, China introduced the 11th Five Year Plan (FYP) for environmental protection, whose implementation lasted until 2010. The focus of the policy was to reduce Sulfur oxide emissions by 10%, targeting vehicle pollution, improving the quality of gasoline, reduce desulfurization in coal-fired plants, and pollution control in industrial pollution sources.[34] The policy also sought to reduce energy consumption, where the target was 20% per unit of the 2005 GDP. Until 2005, the policies to reduce emissions in China were ineffective, but things changed between 2006 and 2012 when new instruments incorporating political incentives were launched as part of the 11th Five-Year Plan for reducing emissions. A challenge leading to the ineffectiveness of the air protection policies introduced in China prior to 2005 was because some targeted a single primary pollutant and there lacked political will and support to the enforcement of the policies.[35]

The 12th Five-Year Plan (FYP) is the other important policy previously introduced by the Chinese government in 2010 and implemented until 2015 sought to manage and control air pollution. The policy targeted the reduction of energy consumption and of potential emissions that increase air pollution. The role of the Energy Conservation and Emissions Reduction (ECER) in the period was to reduce energy consumption per GDP capita by 20% and to cut Sulfur oxide emission by 10%, desulfurization in coal-powered plants, and limit the development of industries having high energy consumption. The policy aimed at reducing SO_2 emissions by 8%, and Nitrogen Oxides by 10%, through controlling emissions of

[33] Kebin He et al. "A review of 20 years' air pollution control in Beijing."
[34] Zongwei Ma et al. "Effects of air pollution control policies on PM 2.5 pollution improvement in China from 2005 to 2017: A satellite-based perspective." *Atmospheric Chemistry and Physics* 19, no. 10 (2019): 6861-6877.
[35] Yana Jin, Henrik Andersson, and Shiqiu Zhang. "Air pollution control policies in China: a retrospective and prospects." *International Journal of Environmental Research and Public Health* 13, no. 12 (2016): 1219.

NO_x in ships and vehicles and implement desulfurization in industrial sectors and coal-powered plants. ECER for the 12th FYP policy was to cut energy consumption per GDP capita by 16%, SO_2 by 8%, and NOx pollution by 10%. The goals would be achieved through controlling the starting of industries with high power consumption, reduce energy consumption in transportation, building, industrial, civil, and commercial areas, and increase emission minimization in key industrial areas.[36] Closely linked, the other important environmental protection policy that has been introduced in the period is the 12th FYP on APPC-KR[b], introduced in 2010, and implemented until 2015. The goal of the policy was to reduce SO_2, NO_x, and industrial PM by 1%, 13%, and 10% respectively. This would be achieved through introducing regional-specific management, increase restrictions for energy use in projects with high pollution and energy consumption, optimize industrial layout, introduce joint regional prevention and control mechanisms, and increase efficient utilization of coal. The APPCP-AP policy was introduced in 2012 and implemented in 2017 to cut $PM_{2.5}$ pollution in Beijing, Delta River, and Jingjinji. The major measures for the policy included the optimization of industrial layout, establishing a monitoring and warning system in the event of heavy pollution, increasing the utilization of clean energy, increasing efficiency with energy consumption, upgrading industrial structure, reducing excess capacity, and promoting comprehensive air pollution control in plants. The different policies have been effective as they have helped China achieve significant success to control air pollution, specifically in $PM_{2.5}$ pollution control.[37]

Furthermore, in President Jinping's leadership, the Chinese government has demonstrated significant commitment towards improving air quality to mitigate associated threats. For instance, the President announced the "Energy Revolution" policy in 2014, which was in

[36] Zongwei Ma et al. "Effects of air pollution control policies on PM 2.5 pollution improvement in China from 2005 to 2017: A satellite-based perspective." *Atmospheric Chemistry and Physics* 19, no. 10 (2019): 6861-6877.
[37] Zongwei Ma et al. "Effects of air pollution control policies on PM 2.5 pollution improvement in China from 2005 to 2017: A satellite-based perspective." *Atmospheric Chemistry and Physics* 19, no. 10 (2019): 6861-6877.

support of the "12th Five-Year Plan" seeking to enable China to achieve the energy transition. This could be achieved through a reduction of air pollution targeting NO_x, SO_2, $PM_{2.5}$, mercury, and black carbon. The energy transition policy will reduce the consumption of coal from 66% in 2015 to 20% in 2050 for renewable energy sources, which will contribute to a drastic reduction in air pollution.[38] The Chinese government released the Energy revolution Strategy (2016-2030), which acted as a response policy after the United States withdrew from the Paris Climate Agreement. The policy has been developed such that it ensures consistency with GDP carbon dioxide intensity targets in China. Through the policy, the Chinese government has prioritized increasing efficiency in energy consumption, where the focus is on capping primary energy and checking unreasonable energy consumption. The energy revolution policy will also enable China to diversify energy sources focusing on renewable energy and clean coal for production purposes.[39] This way, the country will be able to improve the air quality and environmental health for the well-being of the Chinese citizens. The Energy Revolution Strategy has limitations considering that it cannot help the Chinese government to achieve a carbon dioxide peak before 2030.[40] Nevertheless, environmental protection has been a priority issue for President Xi Jinping since he assumed office in 2013. This is evident considering that the president has embedded environmental issues of environmental sustainability in the government's portfolio as announced during the Third Plenum of the 18th Party Congress. In his terms, President Jinping declared "war" on air pollution and related threats. President Jinping's government will fine individuals and companies accused of air pollution. The environmental policy reforms as has happened in

[38] Kejun Jiang et al. "Energy transition, CO 2 mitigation, and air pollutant emission reduction: scenario analysis from IPAC model." Natural Hazards 99, no. 3 (2019): 1277-1293.
[39]Qilin Liu, Qi Lei, Huiming Xu, and Jiahai Yuan. "China's energy revolution strategy into 2030." *Resources, Conservation and Recycling* 128 (2018): 78-89.
[40]Qilin Liu, Qi Lei, Huiming Xu, and Jiahai Yuan. "China's energy revolution strategy into 2030." *Resources, Conservation and Recycling* 128 (2018): 78-89.

China in recent years, will provide the citizens with clean air and depict China as a global leader on environmental issues.[41]

The Beijing Clean Air Action Plan (2013-2017) has played a vital role to support efforts for improving air quality in China. The policy is considered to be one of the most comprehensive policies that Beijing has pursued as part of its pollution control programs. Through the policy, China managed to reduce its annual $PM_{2.5}$ concentration in 2017 to 58μg/$m^{3,}$ which represented a 35.6% reduction as compared to 2013. The gains enabled China to enhance its air quality goals in the country and abroad. In the period, the policy enabled Beijing to reduce air pollution from NO_x, SO_2, $PM_{2.5}$, and VOCs with 43%, 83%, 55%, and 42% respectively.[42] Besides, in 2018, the Chinese government launched the Three-year Action Plan to Win the Blue Sky Defense War, seeking to reduce air pollution in China and increase the duration of the blue sky. The strategy has contributed to a reduction of $PM_{2.5}$ and PM_{10} concentration in cities every month with 14.49 and 23.43. Based on the policy, it was revealed that successful environmental protection policies are to incorporate effective environmental governance policies, have necessary structural adjustments, and increase the timeliness and transparency of information disclosure.[43]

Additionally, the 13th Five-Year Plan is another crucial policy that the Chinese government pursued between 2016 and 2020 to introduce integrated and ambitious environmental protection goals. The plan shifted China's focus to address the threat of air pollution from controlling total emission to improving air quality. The 13th FYPs has emphasized the need for China to strengthen environmental governance targeting the coordination of environmental policies in different government levels, organizing national environmental

[41] Christine Wong and Valerie J. Karplus. "China's war on air pollution: can existing governance structures support new ambitions?" *The China Quarterly* 231 (2017): 662-684.
[42] Kebin He et al. "A review of 20 years' air pollution control in Beijing."
[43] Pu Wang. "China's air pollution policies: progress and challenges." *Current Opinion in Environmental Science & Health* (2020): 100227.

institutions, and coordinating relations with other stakeholders. In 2018, the plan strengthened Ministry of Environmental Protection's (MEP) authority to establish integrated and coherent approaches to control and prevent pollution in China. The plan has led to the tightening of air quality standards and the promotion of government's officials is based on the ability to achieve ambient air quality and emissions reduction targets.[44] The 13th FYPs combined with related policies including the 11th and 12th FYPs have enabled China to increase public awareness, mobilize essential resources, and focus national efforts to achieve tangible environmental health results.[45] However, although the different environmental protection policies in China have contributed to significant progress towards the improvement of air quality, the air quality levels in the country trail the expected global standards. China has been unable to attain the desired air quality standards across the country. For instance, even though the 13th and 14th FYPs have sought to reduce emissions leading to air pollution in China, over two-thirds of 338 major Chinese cities have NO_x, SO_2, and $PM_{2.5}$ concentrations that exceed WHO limits with several times. Also, there are frequent severe incidents of air pollution across Chinese cities, suggesting that the problem of air pollution is prevalent. Thus, more policy responses to the threat of air pollution will have a significant contribution towards supporting the country's focus to deal with environmental pollution problems.

The recent policy (basis of the project) that is being implemented is the 14th Five-Year Plans where focus is to enable China to realize economic growth while promoting initiatives for environmental sustainability and health. The plan was introduced by the Chinese government in 2021 and will be implemented until 2025. The policy presents a plan that the government has towards reducing emissions to improve environmental health while

[44] Chan Yang. "Policies, regulatory framework and enforcement for air quality management: The case of China." (2020).
[45] Chan Yang. "Policies, regulatory framework and enforcement for air quality management: The case of China." (2020).

supporting innovative-driven growth of the economy. The policy will enable China to increase the production of non-fossil fuel energy to reach 20% of the country's energy mix by 2030 and halt the development of coal-powered plants.[46] The policy is perceived as critical to shaping the future of China and of the world eco-civilization, inclusive, resilient, and sustainable growth. The plan will support China to tackle climate change problems through targeting the achievement of carbon neutrality by 2060 and increasing efficiency in energy consumption while opting for cleaner energy alternatives. China is pursuing a clean energy transition where the government seeks to reduce the consumption of coal, for cleaner alternatives domestically and internationally.[47] The move is aimed at reducing the potential sources of carbon emissions, which increase the threats of air pollution in China. The Chinese citizens are concerned about the increased threats of air pollution in the country. Thus, the public is supportive of the initiatives by the Chinese government to improve environmental health such as through the 14th FYPs. As mentioned in the problem statement section, whereas the 14th FYP is an ambitious plan to enable China to confront the problem of air pollution, it has limitations considering that the plan is not explicit regarding the achievement of the targets. For instance, the plan fails to explain how the energy and carbon intensity targets of 13.5% and 18% respectively will be attained between 2021 and 2025.[48] This suggests the need to improve the policy to be specific on the initiatives that will enable China achieve the climate change and air quality goals as set domestically and internationally.

Actors in Chinese Air Pollution

[46] Nicholas Stern and Chunping Xie. "China's new growth story: Linking the 14th Five-Year Plan with." (2021).
[47] Cameron Hepburn et al. "Towards carbon neutrality and China's 14th Five-Year Plan: Green COVID-19 recovery." (2021).
[48] Hongqiao Liu et al. "Q&A: What does China's 14th 'five-year plan' mean for climate change?" *Carbon Brief*, March 12th, 2021.

The Chinese government including the President, the Ministry of Environmental Protection, local authorities, and legislators are critical actors on matters of air pollution in the country. As revealed above, the government is responsible for developing and implementing policies and legislations to reduce air pollution in China. The government feels that air pollution has increased in the recent past, but as new policies are being implemented, the situation is positively changing.[49] Global agencies such as the World Health Organization (WHO) and the World Bank are other key players in supporting China to confront the threat of air pollution. WHO sets air quality standards that China and other players in the world should strive to protect their people from air pollution. The World Bank is an important actor in China's efforts to improve air quality through financing investments to increase the development of clean energy, and that will increase energy efficiency for reducing carbon emissions and air pollution.[50] The international agencies claim that air quality is below the global standards, suggesting the need for stricter measures against air pollution. Finally, local business leaders are key actors influencing China's air pollution issues, considering that they are responsible for developing strategies to guide their businesses on environmental-friendly practices as required by the government. However, most Chinese companies are accused of worsening air pollution levels in the country,[51] which is an indication that the business leaders are not in support of policies to reduce air pollution. Rather, their priority is on revenue generation and increased business profitability.

[49] UNEP." Beijing air improvements provide model for other cities". 2019. UNEP. https://www.unep.org/news-and-stories/press-release/beijing-air-improvements-provide-model-other-cities

[50] World Bank. "Helping China Fight Air Pollution". 2018. World Bank. https://www.worldbank.org/en/news/feature/2018/06/11/helping-china-fight-air-pollution.

[51] Jagdish Madan. "Most of Chinese companies responsible for air pollution, says ministry report". 2021. The Times of India. https://timesofindia.indiatimes.com/world/china/most-of-chinese-companies-responsible-for-air-pollution-says-ministry-report/articleshow/84249067.cms.

Description of Policy Proposal

Policy Goal

The goal of the policy is to improve the air quality in China by increasing the production and use of renewable energy sources in the manufacturing and transportation industries by 35% in the next 10 years.

Proposal

As revealed in the history/background section of the policy, the Chinese government has in different times put in place a variety of policies to confront the problem of air pollution. Although the policies have contributed to significant improvement in air quality, if combined with more measures and policy responses for environmental protection, there is a high likelihood that China's air quality levels will meet the global standards sooner. Therefore, based on the analysis and the limitations identified with the previously implemented policies for air quality improvement, the proposed policy reform should combine the current policies that have proved to be effective, with increased use of renewable energy to reduce the release of air pollutants from the manufacturing and transportation sectors to the environment. Also, renewable energy should be commonly used in the Chinese transport industry considering that worldwide, the transport sector is one of the major contributors to air pollution because of the use of fossil fuels. It was recently established that one in every five deaths in the world is linked to the production and use of fossil fuels. The burning of fossil fuels will increase exposure to fine particulate matter, which was linked to 8.7 million deaths in the world in 2018 alone.[52] The proposal will most likely be successful considering that the Chinese customers have expressed strong support and positive attitudes towards

[52] Clara Chaisson. *Fossil fuel air pollution kills one in five people*. 19 February 2021. https://www.nrdc.org/stories/fossil-fuel-air-pollution-kills-one-five-people (accessed 10 08, 2021).

companies that utilize renewable energy sources in their manufacturing and operational activities.[53] This is a clear indication that if Chinese manufacturing firms and players in the transport sector commit to using renewable energy sources, they might realize more financial benefits because of increased support by the customers. Additional benefits will be realized to the environment, where increased production and utilization of renewable energy sources will significantly improve the air quality, reducing disease incidents and the associated burdens and costs.

Furthermore, another solution related to the production and use of renewable energy in the transportation sector is banning fossil-fueled vehicles for car models that rely on renewable energy sources. Specifically, in response to the air pollution threat from the transportation sector, President Jinping's government should lead China with the banning of fossil-fueled vehicle models for the electrified and hybrid models, which are more environmentally friendly. The Chinese government appreciates the significant contribution that shifting to the electric and hybrid vehicle models could have towards improving environmental health, and air quality for improved public health. Consequently, the government introduced a national strategy for the development of electric vehicle models, which contributed to China's emergence as the world's leading manufacturer of electric vehicles in 2015.[54] This is anticipated to contribute to significant improvement including in air quality in the country. Unfortunately, the technologies for manufacturing the electric vehicle models are not competitive compared to the global marketplace, which introduces concerns about the effectiveness of the technologies in improving air quality in the Chinese transport sector.[55] The proposed policy fills the gap as it will ensure that the technologies used in the electric

[53] Aira Hast, Behrang Alimohammadisagvand, and Sanna Syri. "Consumer attitudes towards renewable energy in China—The case of Shanghai." Sustainable Cities and Society 17 (2015): 69-79.
[54] Jiuyu Du, Minggao Ouyang, and Jingfu Chen. "Prospects for Chinese electric vehicle technologies in 2016–2020: *Ambition and Rationality*." Energy 120 (2017): 584-596.
[55] Jiuyu Du, Minggao Ouyang, and Jingfu Chen. "Prospects for Chinese electric vehicle technologies in 2016–2020: *Ambition and Rationality*." Energy 120 (2017): 584-596.

vehicle models meet the global standards and guidelines, thus contributing to significant improvement in the air quality levels in China going into the future.

Finally, recently, 139 countries started roadmaps for the transition of their energy sources to 100% renewable energy across different sectors including the manufacturing and transportation sectors. The goal of this is to reduce incidents of global warming by 1.5^0C, which is vital to improving the air quality. The associated outcomes are that the deaths from air pollution will reduce from the annual millions as reported today. The achievement of 100% wind, water, and solar power is a feasible solution to confronting the threats of air pollution in China.[56] This is because other countries have committed to achieving the goals, and China could also be committed to achieving the goals, as well. It is estimated that if proposals to exploit the use of renewable energy sources are put in place, there will be 80% transition by 2030, and 100% transition by 2050.[57]

Policy Authorization Mechanism

The authorization mechanism for the policy proposal will be the executive authority (action). The executive authority is issued by the president when there are emergency situations. The executive authority could effectively work in China's approach to air pollution threats and related issues considering that issues for climate governance are controlled by the central government, which the president heads. The Chinese central government has the authority to change the "rules-of-the-game".[58] The focus of the executive authority is to give directives on policies to address the problems, experienced in a country. As revealed above, the problem of air pollution is an emergency situation in China considering the economic

[56] Mark Z. Jacobson et al. "100% clean and renewable wind, water, and sunlight all-sector energy roadmaps for 139 countries of the world." Joule 1, no. 1 (2017): 108-121.
[57] Mark Z. Jacobson et al. "100% clean and renewable wind, water, and sunlight all-sector energy roadmaps for 139 countries of the world." Joule 1, no. 1 (2017): 108-121.
[58] Xiaochen Gong, Yunxia Liu, and Tao Sun. "Evaluating Climate Change Governance Using the "Polity–Policy–Politics" Framework: A Comparative Study of China and the United States." Sustainability 12, no. 16 (2020): 6403.

burdens, public health risks, and the mortalities recorded from environmental pollution every year. Consequently, President Jinping should consider air pollution as an emergency problem in China, and announce executive actions to confront the problem and associated threats. The executive actions should be clear on the threats that the manufacturing and transportation sectors contribute to air pollution (discussed above), and issue directives for increased use of clean and renewable energy sources as the ideal solutions that will reduce the emission of air pollutants.

The Implementation Tool

The implementation tools for the policy proposal should happen through grants, tax incentives, and fines targeting players in the Chinese transportation and manufacturing sectors. The grants and tax incentives should be provided to investors who are willing to start renewable energy production facilities to support initiatives to increase the production of renewable energy. The Chinese government, through the Ministry of Finance and the Ministry of Ecology and Environment (MEE) introduced an environmental fund targeting green projects and firms. By July 2019, the environmental fund had raised $12.59 billion (88 billion Yuan) to be invested in national strategic programmes.[59] The companies in need of the grants will be required to make applications to MEE, detailing how they intend to contribute towards increasing the production and use of renewable energy sources in China. After receiving the applications, MEE, the authorizing agency, will determine eligibility, then issue grants of 4-6 million Yuan, per company. The categorical grants, issued based on a specific purpose, will provide financial resources to start renewable energy production companies in China, contributing to the primary goal of the policy. MEE should closely

[59] Reuters. "China's new green development fund raises $12 billion in phase 1."July 2020. https://www.reuters.com/article/us-china-environment-idUSKCN24T0E0.

monitor how the money is utilized. Equally, China's corporate tax rate is 25%,[60] but should be reduced to about 20% for businesses intending to invest in renewable energy sources. Related decisions are responsibilities of the Ministry of Finance, responsible for developing tax policies, and the State Administration of Taxation that collects tax.[61] Through such initiatives, this will attract new entrants and significantly boost increased production of the renewable energy sources.

The fines are to be imposed by MEP on stakeholders in the manufacturing and transportation sectors who fail to put in place strategies and practices to improve the air quality, based on the government imposed directives and standards. For instance, once the Chinese government introduces the requirements to adopt renewable energy in the transportation and manufacturing sectors, those who fail to adhere are to be fined. However, it is possible that some players in the Chinese manufacturing and transportation sectors might be willing to pay the fines for non-compliance to the air pollution executive authority requirements, especially where the gains exceed the fines. In 2017, fines for environmental violations in China increased with 48% between January and October.[62] This is partially contributed by low fines, such as the proposal for a $4,500 fine for firms that engage in carbon emission cheating.[63] Thus, the fines should be set at a figure that is high enough, such as 20-50% of revenues in every company violating the standards, depending on potential pollution risks. This will force stakeholders in the Chinese manufacturing and

[60] Trading Economics. "China Corporate Tax Rate." 2021.

[61] The People's Government of Beijing Municipality. "Notice of the Ministry of Finance, State Taxation Administration, Ministry of Science and Technology, and China National Intellectual Property Administration on Policies Pertaining to Pilot Projects of Corporate Income Tax for Transfer of Technology in Designated Areas of Zhongguancun National Innovation Demonstration Zone." 21, March 2021. http://english.beijing.gov.cn/investinginbeijing/WhyBeijing/lawpolicy/policies/202103/t20210319_2312181.html .

[62] Reuters. "China fines for environmental violations up 48 percent from Jan-Oct: ministry." December 06, 2017. https://www.reuters.com/article/us-china-environment-idUSKBN1E0089.

[63] Bloomberg. "China proposes tiny 4500 fine for carbon market cheaters." https://www.bloomberg.com/news/articles/2020-11-02/china-proposes-tiny-4-500-fine-for-carbon-market-cheaters.

transportation sectors to adopt strategies and practices for using renewable energy considering the imminent risks.

The implementation of the executive authority will happen as legal directives and policies through the Ministry of Ecology and Environmental (MEE), changed in 2018 from the Ministry of Environmental Protection (MEP), which is an executive branch of the Chinese central government that is concerned with the implementation of environmental policies and the enforcement of environmental regulations and laws.[64] Air pollution is an eminent threat confronting air quality in China, but with the consideration of the executive orders, MEE should draft new policies and legislations and update the existing ones, seeking to integrate the suggestions in the proposal for enhanced response to air pollution in the country. Previously, MEP has led the Chinese government's efforts to integrate policies aimed at confronting the threats of air pollution. For instance, MEP launched the "Blue Sky" campaign to promote cleaner air quality in China, particularly during mega-events like the 2014 APEC summit, the 2008 Olympic Games, and the 2016 G20 summit. Such campaigns are aimed at increasing collaboration between different stakeholders like local authorities and environmental engineers on overseeing measures for air quality and smog control.[65] Besides, in early 2013, MEP introduced ambient air quality standards and ranked air quality in 74 Chinese cities. This sought to increase competition across cities to put in place measures to confront air pollution. The ranking has indicated that in recent times, air quality ranking across cities has improved, and sustainable development strategy and industrial restructuring will contribute to further improvement in air quality.[66] Thus, MEP's integration to MEE will play a vital role in the implementation of the executive authority that President

[64] Federica Monti. "Chinese Environmental Protection: Between National Laws and Governance System." *In China and Europe's Partnership for a More Sustainable World*. Emerald Group Publishing Limited, 2016.
[65] Yongdong Shen and Anna L. Ahlers. "Blue sky fabrication in China: Science-policy integration in air pollution regulation campaigns for mega-events." *Environmental Science & Policy* 94 (2019): 135-142.
[66] Ni Sheng and U. Wa Tang. "The first official city ranking by the air quality in China—a review and analysis." *Cities* 51 (2016): 139-149.

Jinping will issue to improve air quality in China as proposed in the policy. The representatives from all the Chinese manufacturing and transportation sectors need to be involved in the process, considering that once MEE develops or updates the relevant policies, the representatives will be responsible for their implementation in their specific industries. The threat of air pollution poses a significant risk to China and the implementation of the policy should start soonest possible (in the next 2 months at the latest), to ensure that the policy goal is achieved in a timely manner. Any delay to implement the policy will affect the ability to achieve the 2031 air quality improvement targets in China.

Whereas there might be a need to consider budget adjustments when there are policy modifications as suggested above, China already has agencies and personnel responsible for the implementation of environmental-related proposals. This insinuates that there will be insignificant budgetary adjustments because MEE is currently responsible for environmental policies implementation and monitoring. However, the money for the grants should be up to $60 billion (386.6 billion Chinese Yuan) every year, seeking to encourage start-ups for renewable energy production. With more renewable energy supply, there is increased likelihood of its use in the Chinese manufacturing and transportation sectors.

Policy Analysis

One of the core mandates of the Chinese government under the leadership of President Jinping is to protect the lives of the Chinese citizens. This will involve putting in place strategies and programs aimed at promoting health among the people. The proposed policy will help accomplish the goal, by contributing to a significant improvement in air quality, which is noted to positively impact on public health. This is emphasized through a recently conducted study aiming at evaluating the impact of the previously government-led clean air actions in China since 2013 that have similar approach to the proposed actions in the

proposal. For instance, the 12th FYP (2010-2015) aimed at reducing energy consumption and related pollution from coal power sources. Nevertheless, the Chinese government has pursued strict emission control measures including the 2013 promulgation of the Air Pollution Prevention and Control Action Plan. Though the policy, the mortality linked to PM2.5 decreased to 1.10 million (95% Cl: 0.95, 1.25) from 1.22 million (95% Cl: 1.05, 1.35), representing a reduction of mortality from air pollution in China with 9.1%.[67] Besides, as the air quality improves through reduced air pollution and related emissions in China as supported by the policy advocating for increased production and use of renewable energy, the public health status is expected to significantly improve in the future. For instance, coal-intensive electrification is noted to contribute to improved air quality leading to significant health benefits, 41,000 to 57,000 deaths will be reduced every year.[68] This reiterates the critical role that the proposed policy could play towards improving air quality for the betterment of public health in China.

Nevertheless, as revealed above, part of the policy proposal will involve banning fossil-fueled vehicles for hybrid and electric vehicle models. China has planned to phase out the fossil-fueled cars from its market by 2035, for hybrid and electric or fuel cell powered vehicles. Globally, China is leading with the adoption of the electric and hybrid vehicle models considering that in 2019, over half of the new energy cars sales worldwide happened in China.[69] Thus, if China maintains the speed of implementing the ban, it will be possible to achieve the intended targets for air quality improvement. Consequently, with increased fleet electrification for cleaner energy alternatives, China will manage to improve the air quality yielding more health benefits to its people. For instance, it is estimated that by 2030, the

[67] Yixuan Zheng et al. "Air quality improvements and health benefits from China's clean air action since 2013." *Environmental Research Letters* 12, no. 11 (2017): 114020.
[68] Wei Peng et al. "Potential co-benefits of electrification for air quality, health, and CO2 mitigation in 2030 China." *Applied energy* 218 (2018): 511-519.
[69] We Forum. "China joins list of nations banning the sale of old-style fossil-fuelled vehicles." 2020. https://www.weforum.org/agenda/2020/11/china-bans-fossil-fuel-vehicles-electric/.

electrification of 27% of the private vehicles and some commercial fleets will reduce air pollution from nitrogen dioxide, particulate matter, and ozone concentrations. With such a significant level of reduction of air pollution in China, the premature deaths associated with air pollution are projected to drop by 17,456 by 2030.[70] Thus, when the new proposal is combined with other policies to confront the threats of air pollution in China, there will be a remarkable improvement in the air quality levels, helping attain the 2035 targets sooner. This will have a significant contribution to human health including in urban China, where there is a high population and high levels of pollution from increased manufacturing and transportation activities. More health benefits will be realized as more electric vehicle models are introduced whereas the non-electric vehicle models are phased out.[71] The transportation sector is identified as a major source of increased incidents of air pollution. This is experienced through increased levels of particulates in the environment, Sulfur oxides, nitrogen oxides, and volatile organic compounds from combustion processes whose increase affects human health. However, if the utilization of sustainable and renewable energy sources in the transportation sector, as proposed, will lead to significant improvement in air quality.[72] The benefit of such initiatives as proposed in the policy will lead to tremendous environmental, social, and economic benefits. An increase in the electric buses is noted to lead to better health outcomes as the health complications from air pollution will be mitigated. Renewable energy sources such as solar and wind are cheaper as has been witnessed in Norway and California which makes the energy sources desirable and economical to use.[73] Thus, continued fleet electrification and the increased use of renewable

[70] Xinyu Liang et al. "Air quality and health benefits from fleet electrification in China." *Nature Sustainability* 2, no. 10 (2019): 962-971.
[71] Enrico Ferrero, Stefano Alessandrini, and Alessia Balanzino. "Impact of the electric vehicles on the air pollution from a highway." *Applied Energy* 169 (2016): 450-459.
[72] Larry E. Erickson and Merrisa Jennings. "Energy, transportation, air quality, climate change, health nexus: Sustainable energy is good for our health." *AIMS public health* 4, no. 1 (2017): 47.
[73] Larry E. Erickson and Merrisa Jennings. "Energy, transportation, air quality, climate change, health nexus: Sustainable energy is good for our health." AIMS public health 4, no. 1 (2017): 47.

energy in China as proposed in the policy proposal will have more desirable health and economic benefits in the country in the coming decades.[74]

Additionally, a variety of other studies have been previously conducted seeking to understand the economic benefit linked with improved air quality and better health. The same benefits as discussed in the section could be realized in China, through the proposed policy. For instance, in South Korea, the reduction of PM10 concentration in 2014 and 2015 led to significant economic benefit amounting to 7022 (95% Cl: 599, 20496), 2617(95% Cl: 216, 7750), and 1328(95% Cl:-159, 4679) billion KRW for all respiratory and cardiovascular mortalities within the period.[75] A related study explored the economic benefits linked with climate mitigation and improved air quality among Asia countries, where significant benefits were realized. Reduced air pollution is projected to reduce premature deaths in the region by 0.79 million by 2050. The economic value is life savings estimated as USD 2.8 trillion (6% GDP), which exceeds the costs of climate mitigation of 2% GDP or USD 840 billion. Besides, with improved air quality and improved health of citizens in Asian countries, the region will have increased life value savings and per capita GDP gain, which is critical for economic growth and prosperity.[76] As aforementioned, China is a country experiencing increased premature deaths from air pollution. However, with the proposed policy to increase the use of renewable energy sources in manufacturing and transportation sectors, there are significant health and economic benefits that the country will realize. With improved air quality in China as supported through the increased manufacturing of electric vehicle models, premature deaths in the country reduce by between 329,000 and 1,611,000 people every year. In China, the reduction of greenhouse gases and combined health benefits from

[74] Xinyu Liang et al. "Air quality and health benefits from fleet electrification in China." *Nature Sustainability* 2, no. 10 (2019): 962-971.
[75] Daeun Kim et al. "Estimation of health benefits from air quality improvement using the MODIS AOD dataset in Seoul, Korea." *Environmental Research* 173 (2019): 452-461.
[76] Yang Xie et al. "Co-benefits of climate mitigation on air quality and human health in Asian countries." *Environment International* 119 (2018): 309-318.

improved air quality through electric vehicles are US2015$6–187 billion, US2015$33–1102 billion, and US2015$49–1588 billion in LP- LR (Low AEV penetration-low renewable penetration), HP-HR (high AEV penetration-high renewable penetration), and MP-HR (Maximum AEV penetration-high renewable penetration) scenarios.[77] Therefore, the efforts to realize more economic gains from improved air quality in China will be supported through more initiatives to improve the environmental health in the country, as proposed in the policy.

However, the Chinese government should understand that whereas the increased production and use of renewable energy sources in the manufacturing and transportation sectors significantly improve the air quality, shift to the electric vehicle models does not guarantee improved air quality and better public health among its people. This is because the electric vehicles are more effective towards improving the air quality if the electric mix is from proven renewable energy sources and the manufacturing of the batteries should happen far from the regions they are to be used. The need to be cautious is because in India, increasing vehicle manufacturing industries following increased demand for electric vehicles are linked to increased levels of air pollution, for instance through battery manufacturing.[78] Besides, there exist disputes regarding the environmental benefits that are linked with the increased adoption of electric vehicles in China, considering that some of the vehicle models rely on power from the burning of coal, leading to increased air pollutants like nitrogen oxides and sulfur dioxide. Sulfur dioxide emissions in northern China provinces like Hebei, Shanxi, and Shandong, are noted to be increasing because of electric vehicles.[79] Nevertheless, as aforementioned, the electrified vehicle models will be more effective in

[77] Liqun Peng et al. "Alternative-energy-vehicles deployment delivers climate, air quality, and health co-benefits when coupled with decarbonizing power generation in China." *One Earth* 4, no. 8 (2021): 1127-1140.
[78] Rachana Vidhi and Prasanna Shrivastava. "A review of electric vehicle lifecycle emissions and policy recommendations to increase EV penetration in India." *Energies* 11, no. 3 (2018): 483.
[79] Fangyi Li et al. "Regional comparison of electric vehicle adoption and emission reduction effects in China." *Resources, Conservation and Recycling* 149 (2019): 714-726.

improving the air quality in China if the globally accepted technologies and guidelines are considered. President Jinping's government should lead by introducing policies like the one proposed in the memo, where Chinese vehicle manufacturers will adhere to the global standards and technologies for improving air quality. The prioritization in vehicle manufacturing should be made on using renewable energy sources, whose emissions are environmentally friendly.

Pros

A key advantage of the policy proposal is that it will supplement the current initiatives by the Chinese government that are aimed at improving the air quality. The policy proposal will lead to a significant reduction in air pollutants from the transportation industries in China. Consequently, the Chinese government will introduce sustainable solutions for confronting air pollution leading to improved public health outcomes among its people. Besides, the proposed policy will enable China to have a healthier and more productive population, which is critical towards supporting the country to realize economic gains, a priority area of President Jinping's leadership. Finally, the policy proposal will bring onboard different stakeholders in the manufacturing and transportation sectors, which will increase public engagement and collaboration towards confronting the problems of air pollution. Lack of public involvement and inadequate collaboration developing and implementing air pollution solutions is identified as a challenge that China currently faces in its response to the air pollution threats.

Cons

A challenge with the policy proposal is that banning the fossil fueled vehicles does not guarantee improved air quality. Some electric vehicle models relying on new energy are noted to produce air pollutants that threaten the air quality. Another limitation with the

policy is that it could take years for tangible benefits in the improvement of air quality to be realized in China. Nevertheless, more investments are needed to put in place an infrastructure for the implementation of initiatives to confront the problems associated with air pollution. In other words, for the implementation of the proposed policy, additional resources will be needed, which most of the stakeholders might not have, leading to potential delay to achieve the targets. For instance, Chinese who might want to buy the electric or hybrid cars could lack financial power to purchase the new-energy powered cars. The Chinese government has been providing subsidies to encourage more people to purchase the environmental friendly car models.[80] Besides, the lithium raw material that China needs to produce batteries for the electric and hybrid cars is imported, 70% from Australia,[81] which might affect the speed of new energy vehicles production. Finally, it is not clear where the banned fossil fueled vehicles will go, which is an issue of critical concern in the policy and other related policies.

Political Analysis

Air quality and politics are closely connected aspects in China, considering the critical role that the Chinese government plays in influencing the development and implementation of related policies and legislations. Chinese cities are noted to be central points for economy, human politics, and culture. Therefore, when there is an increasing threat of air pollution as has been observed across Chinese cities, key political concerns emerge.[82] This explains why President Jinping, a political leader in the country is directly involved to improve the air quality in China. Environmental protection initiatives across Chinese cities are political

[80] We Forum. "China joins list of nations banning the sale of old-style fossil-fuelled vehicles." 2020. https://www.weforum.org/agenda/2020/11/china-bans-fossil-fuel-vehicles-electric/.
[81] Han Hao, Zongwei Liu, Fuquan Zhao, Yong Geng, and Joseph Sarkis. "Material flow analysis of lithium in China." *Resources Policy* 51 (2017): 100-106.
[82] Boqiang Lin and Junpeng Zhu. "Changes in urban air quality during urbanization in China." *Journal of Cleaner Production* 188 (2018): 312-321.

because they become sensitive in particular political periods. For instance, across cities in China, the air quality levels improve days to scheduled visits by President Jinping but drop days later. The trend has been noted from November 2013 to May 2017 suggesting the potential influence that politics have in influencing the improvement in air quality.[83] Another indication that air pollution and policies to improve air quality are political is evident through public unrest and incidents of violent protests seeking to force the Chinese government to take actions for the protection of the environment. For instance, in 2016, protests happened in Sichuan, Chengdu, Heilongjiang, and Jiangsu as the protestors demanded for actions against smog and chemical pollutants. Besides, in 2019, other Chinese cities such as Wuhan witnessed major protests to prevent the construction of a new garbage incineration facility in the area fearing potential threats to air quality.[84] Equally, different Chinese cities and provinces such as Zhejiang Province have in the past experienced protests against increasing risks from industrial air pollution.[85] The protests to force the government to take actions to deal with air pollution happen by individuals, communities, or activists. However, the protests have scaled down and cannot compare with related protests in other parts of the world considering that in China, publicly criticizing the government has associated consequences. Countless Chinese environmentalists have been arrested and are harassed by authorities for protesting against government's inaction to fight air pollution.[86] Such occurrences discourage many potential protests against air pollution from happening in China, despite the air quality significantly deteriorating in recent times. Nevertheless, even

[83]Qingling Shi, Chenchen Shi, and Feng Guo. "National leaders' visits and temporary improvement of air quality: evidence from Chinese cities." *Empirical Economics* 58, no. 5 (2020): 2105-2127.

84 James Griffiths. "China has made major progress on air pollution. Wuhan protests show there's still a long way to go". CNN. https://edition.cnn.com/2019/07/10/asia/china-wuhan-pollution-problems-intl-hnk/index.html. (July 11, 2019).

[85] Yongdong Shen. "Protest against industrial air pollution: A case from Hangzhou city, China". Middle East Institute. https://www.mei.edu/publications/protest-against-industrial-air-pollution-case-hangzhou-city-china. (December 10 2015).

[86] Helen Davidson. "You follow the government's agenda: China's climate activists walk a tightrope". The Guardian. https://www.theguardian.com/world/2021/aug/16/you-follow-the-governments-agenda-chinas-climate-activists-walk-a-tightrope. (August 16 2021).

though the Chinese citizens are willing to put aside political concerns for the country's economic growth, they are not willing to risk their children's health because of the associated threats from air pollution. Consequently, the government is increasing efforts and actions to deal with air pollution.[87]

Furthermore, the environmental policies and legislations such as the environmental law amendments and the Chinese Communist Party's environmental resolutions are politically influenced.[88] The policy proposal will be implemented as an executive order directive indicating that legislative support might not be necessary. In the past, related policies have been implemented with the primary goal of improving the air quality in China, and there has been a high level of support for the policies. For instance, the "Blue Sky" political policy of 2013-2017 launched by the Chinese government has contributed to significant improvement in air quality in the country.[89] The Chinese citizens have demonstrated support to environmental protection initiatives such as the "Blue Sky" during major events considering that it leads to improved air quality. However, there are concerns that the air quality improvement initiatives are short-term measures, and thus not effective in the long term.[90] This indicates that whereas the Chinese citizens support the government's initiatives to improve the air quality, they consider some of the proposals ineffective because they are short-term.

The Chinese transport sector has witnessed the introduction of policies to reduce emissions, which lead to improved air quality in the country. For instance, policies providing the

[87]James Griffiths. "China has made major progress on air pollution. Wuhan protests show there's still a long way to go". CNN. https://edition.cnn.com/2019/07/10/asia/china-wuhan-pollution-problems-intl-hnk/index.html. (July 11, 2019).

[88] Hideki Kitagawa. "Environmental Policy Under President Xi Jinping Leadership: The Changing Environmental Norms." *In Environmental Policy and Governance in China*, pp. 1-15. Springer, Tokyo, 2017.

[89] Yueyi Feng et al. "Defending blue sky in China: Effectiveness of the "Air Pollution Prevention and Control Action Plan" on air quality improvements from 2013 to 2017." *Journal of Environmental Management* 252 (2019): 109603.

[90]Christopher M. McLeod et al. "Blue skies over Beijing: Olympics, environments, and the People's Republic of China." *Sociology of Sport Journal* 35, no. 1 (2018): 29-38.

standards for regulating pollution from passenger and heavy-duty vehicles have been introduced. This includes the regulation of diesel and gasoline fuels to reduce impurities and the installation of technologies that filter diesel particulates after engine combustion.[91] Equally, in 2014, China and the U.S. jointly agreed to pursue climate mitigation efforts that will lead to a significant reduction in carbon dioxide emissions by 2030. The economy-wide policies will introduce permits or taxations for carbon dioxide emissions.[92] Other policies related to the banning of fossil-fueled vehicles, for the electric vehicle models in the country, with the goal of reducing air pollution. The Chinese government has introduced policies requiring vehicle manufacturers in the country to focus on the design and production of hybrid and electric vehicle models. The automobile manufacturers are responding through increased production of electric and hybrid vehicle models, which are considered environmentally friendly. Statistics from the China Association of Automobile Manufacturers indicate that by July 2021, the sales of plug-in hybrids and electric cars in China accounted for 8.7% new sales for a five-month period compared to 5.4% in 2020. It is estimated that by 2025, the sales will increase by 40% accounting for a fifth of car sales in China.[93] The trend indicates that both the manufacturers and the consumers are in support of the increased manufacturing and selling of electric and hybrid car models, which is critical for improved air quality and environmental health. Thus, an advantage of the proposal is that it could realize increased support by different stakeholders who have already embraced the current policies as introduced by the government. However, there could be disadvantages to the automobile manufacturers considering that they will be required to develop new strategies and allocate new resources for the implementation of the new policy proposal. This might require budget

[91] Paul Natsuo Kishimoto et al. "The impact of coordinated policies on air pollution emissions from road transportation in China." *Transportation Research Part D: Transport and Environment* 54 (2017): 30-49.
[92] Paul Natsuo Kishimoto et al. "The impact of coordinated policies on air pollution emissions from road transportation in China." Transportation Research Part D: Transport and Environment 54 (2017): 30-49.
[93] Li Fusheng. "NEVs being embraced by major economies". *China Daily.* http://global.chinadaily.com.cn/a/202107/05/WS60e25d0ca310efa1bd65fa9f.html (07 September 2021).

adjustment, which most of the automobile manufacturers could be resistant to, affecting the effectiveness of the policy proposal.

Recommendation

President Xi Jinping should consider the threat of air pollution as a national emergency, thus issue executive actions seeking to see MEE immediately introduce and improve policies for increased use of renewable energy sources to improve air quality in the China. The tremendous growth in the industrialization levels as supported by a significant increase in manufacturing capabilities and growth of the transport industry in China has led to the air pollution problems experienced in the country. Consequently, targeting the industries should be the priority of the Chinese government under the leadership of President Jinping. Previously, related initiatives have been pursued in the manufacturing and transportation industries, and even though significant benefits have been realized, there are various challenges that confront their effectiveness. For instance, President Jinping requires the local authorities across different cities to put in place long-term measures to improve air quality. Unfortunately, the authorities commit to improving air quality days before the president visits the areas, and the situation worsens after the presidential visits. This is a strong indication that the policies for improving air quality are ineffective and focus on the short-term, ignoring long-term sustainable solutions. Besides, whereas the electric and hybrid vehicle models are assumed to be environmentally friendly, this is not always true because some vehicle models depend on electricity produced from processes that increase air pollution. For instance, the manufacturing of batteries for the electric and hybrid car models is noted to contribute to increased air pollution. As a result, as the Chinese government leads its people with the banning of fossil-fueled vehicle models, there should

be a focus to ensure that the electric and hybrid vehicle models use cleaner and renewable energy sources, with insignificant effects on air quality.

Overall, China trails the global guidelines and standards for improving air quality, indicating that more needs to be done to improve the air quality level. Thus, the proposed policy will address the limitations and weaknesses faced in the implementation of the current policies to improve air quality in China. The implementation of the proposed policy will lead to a more robust and sustainable approach to deal with air pollution challenges that currently confronts China. The implementation of the proposed policy will lead to various key benefits in China. First, with improved air quality in the country, the health outcomes will significantly improve. As revealed above, air pollution has contributed to a significant increase in respiratory and cardiovascular health complications and related mortalities in China. Millions of Chinese citizens develop cardiovascular, respiratory, or die from air pollution-related diseases every year. However, if implemented as suggested, the proposed policy will contribute to a significant improvement in air quality in China and better health. The other benefit to be realized following the implementation of the policy proposal is that tremendous economic benefits will be realized in China. As aforementioned, air pollution leads to increased economic losses in the country, totaling to 1-2% loss in China's GDP. Thus, improved air quality in China will lead to a healthier and more productive population in the country, which is critical to supporting economic prosperity and more support for the growth of China's GDP. Besides, with a healthier population, the healthcare expenditure linked to air pollution that is currently high, will significantly reduce and the saved money could be used to fund other economic development programs in the country. Furthermore, China is focused on becoming one of the world's economic powerhouses and a superpower. Consequently, adhering to the global guidelines and standards for air quality will demonstrate the country's commitment to making the world better for everyone. This will

support China's continued pursuance of strategies to support its course to become a superpower. Also, with increased utilization of clean and renewable energy sources, China will develop long-term and sustainable solutions to the air pollution problem that it currently faces. Renewable energy sources are noted to be efficient and affordable, which indicates that their increased use will enable Chinese firms to save the associated costs, leading to more profitability. President Jinping and his government will not satisfactorily confront the threats associated with air pollution. Rather, there is a need to engage with other stakeholders considering that collaboration leads to more desirable outcomes in the improvement of air quality.

Curriculum Vita

Xiangyi Xu was born in Hangzhou, Zhejiang Province, China on August 1, 1997. Xiangyi Xu came to the United States to study at Gettysburg College in Pennsylvania in August 2016 and received her Bachelor of Arts degree in Organization and Management in December 2019; she began her studies at Johns Hopkins University in August 2020 with a major in Public Administration. She is not currently employed and her future career options may lean toward a career in government.